

REMARKS/ARGUMENTS

Status of the Claims

Prior to making this amendment, claims 1, 5-21, 24-28, and 34-42 were pending in this application. Claims 1,5,10 and 24 have now been amended, so that claims 1, 5-21, 24-28, and 34-42 are now presented for further examination.

Claim1 has been amended by moving the final wherein statement to associate it with the first mention of the modulator. The intention is to emphasize that the modulator and receiving terminal together form a phase shifting reflector. The Examiner correctly recognized that a reference to amplitude had been previously been left in claim1 inadvertently and interpreted claim 1 as was intended. Applicants thank the Examiner for taking this practical approach. The present amendments to claim 1 also rectify this.

Consistently with the amendment to claim 1, claim 5 has been amended to specify that the modulator switches properties of the reflecting terminal (as stated by page 5 lines 18 to 21 of the description).

Claim 10 which referred to the resonator has now been amended to specify that the modulator also comprises a valve for opening and closing the resonator (as taught at page 8 line 13 of the description). Somewhat similarly, claim 24 has been amended to specify that switching between states is by opening and closing access to the resonator.

No new matter is added by the amendments.

Rejection under 35 USC 103

The Office Action rejected claims 1,5-17, 20, 21, 24-26, 28 and 36-42 under 35 USC 103(a) as obvious over Dubinsky US 6757218 (“Dubinsky”) together with Shi et al US2002/180613 (“Shi”). Applicants respectfully disagree.

Dubinsky describes a system in which a signal is transmitted from the surface and information is sent to the surface by modulating the signal as it is reflected back to the surface. By contrast, Shi describes a system in which a signal is created downhole (at transmitter 105) and transmitted to the surface. In short, Shi transmits along a one-way path from downhole to surface whereas Dubinsky and the present invention have a signal which travels both ways, from surface to downhole and back to surface. The arrangement in Shi requires enough downhole power to drive a downhole transmitter.

As previously pointed out, Dubinsky discloses a system which relies on amplitude modulation to impose coding on the signal as the signal is reflected back to the surface. The Office Action has relied on Shi as teaching phase modulation. However, because Shi discloses a one way signal, its modulator 104 operates to modulate the output into a telemetry signal, before the transmitter 105 transforms the telemetry signal into acoustic pulses. Shi has no teaching of a reflector and claim 1 has now been amended to emphasize that the modulator and reflecting terminal form a phase-shifting reflector. Independent claims 21 and 28 call for something similar in that they recite two states of reflection. An uninventive combination of Dubinsky and Shi would not have a downhole reflecting terminal in combination with a downhole modulator so as to receive the acoustic signal from the surface and reflect it with phase modification.

It may also be noted that a combination of Dubinsky and Shi does not compel the reader to choose phase modification. Shi para [0047] recites a range of modulation techniques which include amplitude modulation as well as phase modulation. So, whilst phase modulation was an available possibility, Shi does not single out such modulation and does not disclose apparatus for applying phase modulation while reflecting a received signal.

Applicants note the approach argued in the official action, contending that it would be obvious to create such undisclosed apparatus because the adoption of phase modulation is obvious. It is respectfully submitted that such an approach is hindsight, absent a document which teaches phase modulation when reflecting a received signal.

Even if there was some prior disclosure of a phase shifting reflector, it would not be straightforward to substitute it into Dubinsky. In Dubinsky the source signal is a series of pulses. Such a waveform contains a broad range of frequencies which makes it impractical to impose a phase shift. Dubinsky of course does not envisage phase shift and relies on amplitude modulation to impose a coded signal onto the train of pulses.

The distinction over the prior references is also reinforced in claim 5 as now amended by calling for the modulator to change the properties of the reflecting terminal. Shi has no such feature.

Purpose of Helmholtz resonator

The Office Action argued that the feature of unamended claim 5 was disclosed by Dubinsky in the paragraph bridging columns 4 and 5. Dubinsky refers to a Helmholtz resonator and the Office Action points out that a Helmholtz resonator is also used by embodiments of the invention. At first sight that would suggest similarity, but the ways in which a resonator is used are very different. The reflector taught in this paragraph of Dubinsky is described as changing between a state which reflects strongly and a state which attenuates the signal and so reflects weakly. There is no teaching of reflection with change of phase, neither is there teaching of dimensions which would inherently lead to reflection with a change of phase.

The present description explains its use of a Helmholtz resonator with reference to Figure 1. There is switching between reflection by upper packer 134 when valve 161 is closed, and a second state when there is phase shifting reflection involving the fluid filled volume 132 when the valve 161 is open. Page 9 of the present text quotes formulae which relate the reflecting properties to the dimensions of volume 132. Thus the present description teaches effective reflection, either without change of phase (function of upper packer 134 when valve 161 is closed) or with change of phase (open valve 161 brings Helmholtz reflector into play).

By contrast, Dubinsky's description of Fig 3c shows that the manner in which the Helmholtz reflector is used is entirely different from what is contemplated by the present

description. As a plate or flapper valve is moved, there is a change between reflection and no reflection. This is consistent with Dubinsky's reliance on amplitude modulation and Fig 3b of Dubinsky in which numerals 332a and 332b indicate switching between reflection and zero reflection.

Dependent claims

Applicants wish to comment concerning some of the dependent claims:

Claim 10 as amended specifies a resonator which is switched between open and closed off from the acoustic channel. This feature is absent from the prior references and is used by embodiments of the invention to give phase shifting.

Claims 37, 40 and 42 refer to the frequency of the resonator being matched to the carrier signal. This feature is not suggested by Dubinsky, neither is use of a continuous carrier wave as called for by claim 36, 39 and 41. These features distinguish from Dubinsky's deliberate reliance on a signal which is a series of pulses, giving a range of frequencies so that the resonant frequency of the Helmholtz resonator has little significance. The suggestion in the Office Action that it would be obvious to adopt such expedients is respectfully disputed. The reader is not compelled to merge Dubinsky and Shi and is not compelled to arrive at these further departures from what is disclosed by prior documents.

The Office Action further relies on Priest et al US 5,444,324 in addition to the other prior references against some dependent claims. Claims 19 and 34 call for collection of energy from the acoustic carrier. Priest does not relate to this, but to the use of electrical power available downhole. The passage in column 1 of Priest refers to converting electrical energy into acoustic energy and provides no disclosure of converting acoustic energy to electrical. Neither does it provide any motive to do so. Thus it does not lead to the features of these dependent claims.

For the reasons given above applicants believe that all independent claims and therefore all dependent claims are non-obvious over the cited documents. It is requested that the rejections under 35 USC 103 are withdrawn. Applicants have chosen to discuss some dependent claims. No admission is made or implied concerning the remaining dependent claims.

Conclusion

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

In the event that a fee or refund is due in connection with this Amendment, the Commissioner is hereby authorized to charge any underpayment or credit any overpayment to Deposit Account No 19-0615. If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned.

Respectfully submitted,

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